Tutorial Sheet for Beam Loaded in Shear

Name:

Beam design and dimensions

0.5P   0.5P

110

220

375 | 600 | 1050 | 600 | 375
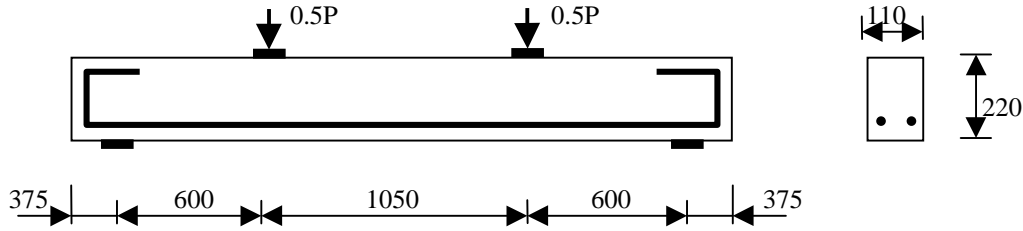
Concrete cube strength $f_{cu} = 51.0\text{N/mm}^2$, tensile strength $f_t = 5.49\text{N/mm}^2$. Bottom reinforcement is 2 T12 bars. Cover is 25mm. Young's Modulus $E_s = 200,000\text{N/mm}^2$ for the steel and $E_c = 30,000\text{N/mm}^2$ for the concrete.

Load-Deflection to Failure for Beam 3

Applied Load (kN) vs Central Deflection (mm)
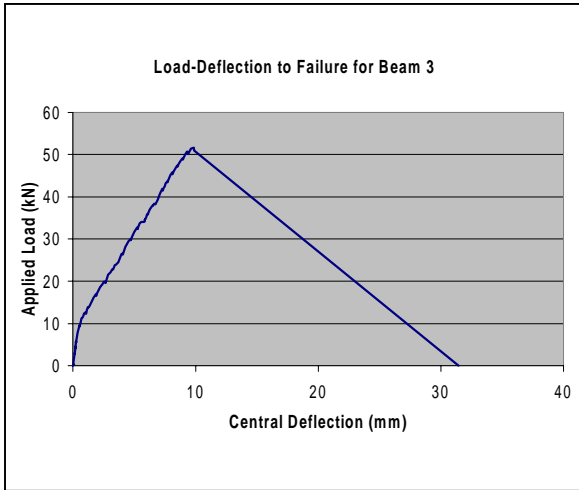
Cracking behaviour

at 15kN:

at 25kN:

at 35kN:

at 40kN:

at failure:

Comment briefly on the behaviour of the beam through the elastic range, during progressive cracking, up to peak load and post-peak behaviour. Comment on whether you think this behaviour was to be expected, and why.

Estimate the cracking load of the specimen from the load-deflection plot. By using a transformed section approach, calculate the predicted cracking load and compare with the actual result. Ignore self-weight. Comment on your result. [Hint: Look at page 91 of your Structures 2 notes]

PTO

By considering both the load-deflection plot and the behaviour of the beam in the video, do you think the longitudinal steel yielded at failure? By considering equilibrium in the constant moment region, predict the maximum strain in the steel bars at failure.

By using relevant clauses from the appropriate code-of-practice, predict the design strength of this beam. Comment on the accuracy and safety of the code-of-practice in this case. Show all calculations below and ignore self-weight.